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# A Modified Early Protocol for Implant Placement: A Retrospective Case Series

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*"...the Modified Early Implant Placement(MEIP, 2-4 weeks) protocol is a viable option in achieving successful esthetic outcomes while reducing implant treatment time..."*

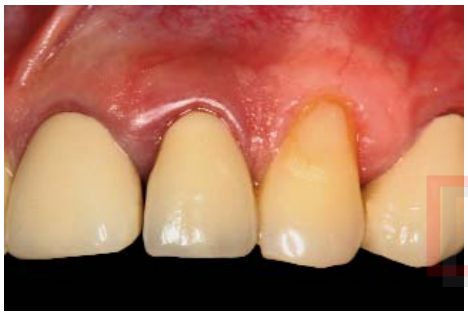

Fig 1. Diagnosed as a hopeless tooth #10

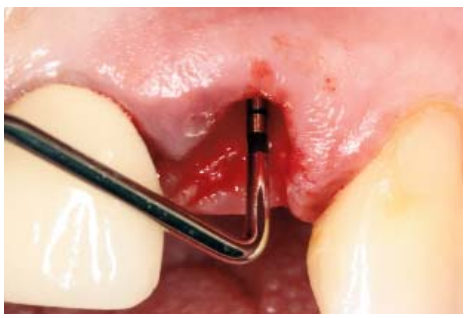

Fig 2. Atraumatic extraction, missing buccal bone

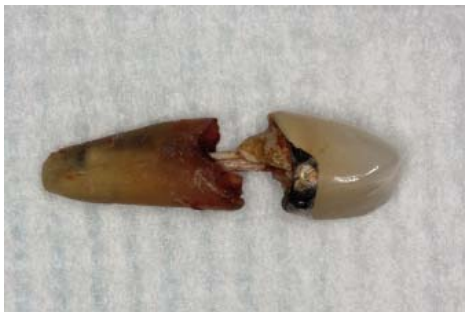

Fig 3. Extraction

The placement and restoration of implant supported prostheses have been shown to be a predictable option for replacement of partially or fully edentulous patient (1). Over the past two decades clinicians have modified traditional protocols to reduce treatment time for implant supported restorations (2). Placing implants immediately following tooth extraction, immediate implant placement (IIP), has emerged as a predictable option for implant restoration of hopeless teeth (3-5). However, recent findings show that extensive resorption of the buccal plate is a common phenomenon following tooth removal (6) even when an implant is immediately placed. Moreover a retrospective review showed buccal soft tissue changes where implants were placed immediately into extraction sockets during an 18-month follow-up period. Forty percent of cases had buccal tissue recession of 1mm or greater (7). In addition if there is deficient bone following tooth extraction, IIP may be contraindication due to lack of buccal bone and soft tissue.

With an increased understanding of extraction socket biology, and to reduce surgical time, alternative techniques have been described. Early implant placement (EIP) was introduced by Buser which involved placing implants 4-8 weeks following extraction to achieve healed soft tissues over the extraction socket (8). Amler described the healing of human extraction sockets showing that 3 weeks after extraction connective tissue fills extraction socket and osteoid mineralization is present as the epithelium covers the extraction socket (9). Therefore instead of EIP, implant placement 2 to 4 weeks following extraction, referred to as modified early implant placement (MEIP), can be a viable option. The advantage of the MEIP protocol compared to IIP is that the clinician is in a better position to evaluate the post healing of the extraction socket. Since soft tissue has grown over the socket, it also allows for easier closure when a simultaneous bone graft or guided bone regeneration procedure is performed.

The purpose of this retrospective case seriest was to document the implant survival rate and aesthetic outcomes following implant placement and grafting procedures performed within 2-4 weeks after extraction (MEIP). Case selection for predictable results, as well as indications and complications of treatment will be discussed.

## MATERIAL AND METHODS

Clinical data in this study was obtained from implant database (ID). This data set was extracted as de-identified information from the routine treatment of patients at the Ashman Department of Periodontology and Implant Dentistry at New York University College of Dentistry Kriser Dental Center. ID was certified by the Office of Quality

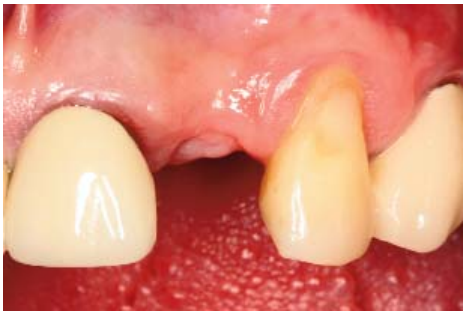

Fig 4. Post-extraction, 3 weeks healing

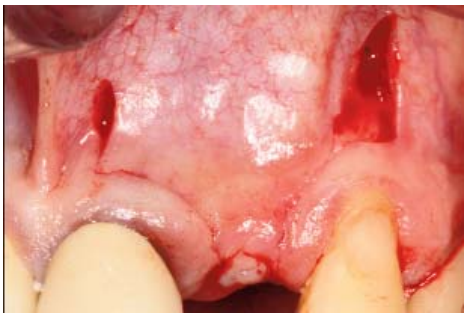

Fig 5. Papilla sparing incision

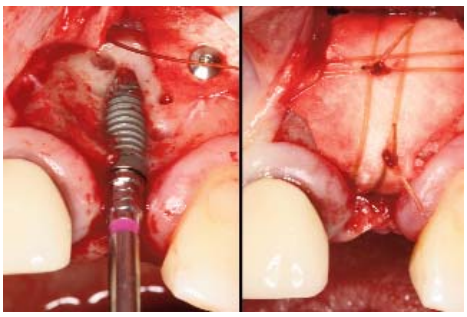

Fig 6. Implant placement + GBR

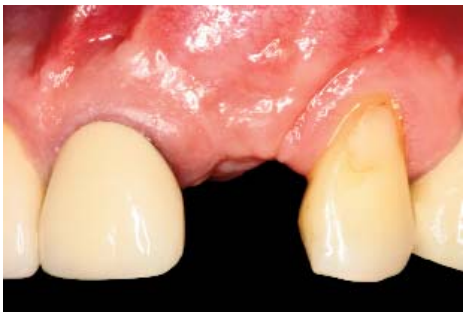

Fig 7. Three months after stage 1 surgery

Assurance at NYUCD. This study is in compliance of the Health Insurance Portability and Accountability Act (HIPAA) requirements.

### Study subjects

Ten consecutive cases from the database that were treated with the Modified Early Implant Placement (MEIP) protocol were included in this study. The population consisted of 4 male and 6 females with a mean age of 38 years (range: 26 to 62). The treatment sites included 12 central and 4 lateral incisors.

### Esthetic outcome evaluation

Two methods were used to evaluate esthetic outcomes; a Modified Pink Esthetic Score (MPES, abridged version of PES) (10) and Patient Satisfaction Questionnaire (PSQ) (11). The MPES evaluates the height of the mesial and distal papilla, the contour of the facial mucosa, tissue color and root convexity. Using a 0-1-2 scoring system, 0 being the lowest, 2 being the highest value, the maximum MPES achievable was 10. Based on the definition, the "score of clinical acceptability" was set by the investigators at a minimum value of 7 out of 10. MPES and PSQ were collected at 3 and 12 months after delivery of the final restoration. Patients reported satisfaction scores as 0 (dissatisfied) to 10 (highest satisfaction) regarding esthetics.

### Inclusion criteria:

Patients who had implants placed using the MEIP protocol with the following parameters: 1) Teeth in the esthetic zone that were extracted due to periodontal disease, root fracture or failure of endodontic treatment. 2) Type II or III extraction socket morphology (partial loss of buccal bone plate or soft tissues) according to Elian et al. (12). 3) Smokers who smoked < 1pack/day. 4) Controlled diabetics.

### Exclusion criteria:

Patients who had implant placement without the MEIP protocol. All patients who had evidence of generalized severe active periodontal diseases, uncontrolled systemic diseases that could interfere with wound healing, bruxers and patients without good compliance were excluded.

### Clinical procedures:

The clinical procedures used were standardized and included the following steps:

1) Tooth extraction without flap elevation (Fig 2).
2) Thorough socket debridement.
3) Extraction sockets were allowed to heal for 2-4 weeks depending on socket diameter and soft tissue healing. Implant placement was performed following this socket healing period (Fig 4).
4) Subjects were prescribed 2g Amoxicillin 1 hour prior to surgery of if allergic, 600 mg of Clindamycin 1 hour prior to surgery was substituted.
5) Mucoperiosteal flaps were reflected using a palatally inclined crestal and papilla preservation incisions with divergent vertical incisions made mesial and distal (starting 2mm from the sulcus of adjacent teeth) (Fig 5).
6) All implants utilized a two stage implant approach featuring surfaces with a resorbale blast media (RBM) in the endosseous portion with a crestally widened implant platform diameter of 4.8mm, a body platform of 3.3mm or 4.1mm and a length of 13mm or 15mm (n=12, Sybron XRT, Grendora, CA, USA) in 7 patients. In one patient, 2 implants with TiUnite surfaces and polished collars with 3.5mm diameter and 13mm length were placed (Nobel Biocare, Yorba Linda, CA, USA). The other two patients had 2 implants with OSSEOTITE surfaces with diameters of 3.25 and 4.0mm and 13mm lengths (3i Biomet, FL, USA). Primary stability of all implants was achieved by undersizing the osteotomies and engaging the crestal bone with the neck of the implants.
7) Prosthetically driven implant placement was performed at a minimum distance (implant-tooth) of 1.5- 2mm apart or minimum distance (implant-implant) of 3mm by using a surgical guide from an ideal wax-up (Fig 6).
8) Implant placement was combined with simultaneous augmentation on

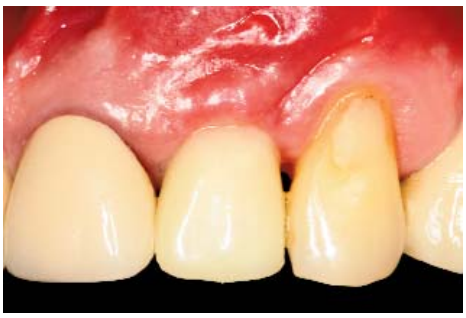

Fig 8. Provisional crown at stage 2 surgery

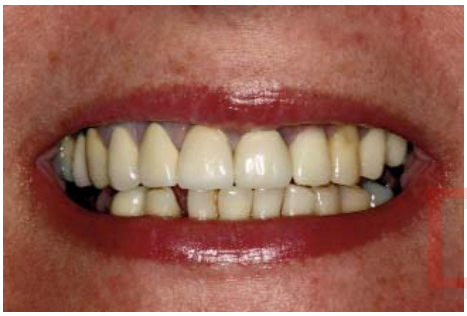

Fig 9. Final restoration #10

the facial aspect using bovine derived bone substitute (Bio-Oss, Geistlich Pharma, Wolhusen, Switzerland) of particle size 0.25-1.0mm and an absorbable collagen membrane (BioMend Extend, Zimmer Dental, CA, USA) for coverage of the graft material. The membrane was stabilized with (Ethicon) 4-0 Chromic Gut periosteal sutures (Fig 6).
9) Flap advancement was accomplished by means of periosteal incision in order to achieve a tension free primary wound closure with 4-0 Chromic Gut sutures.
10) Postoperative care consisted of antibiotics (Amoxicillin 500mg or Clindamycin 150mg) prescribed for 7 days (TID). Chlorohexidine gluconate was prescribed starting 24 hours after surgery and used twice a day for 2 weeks.
11) After a period of 90 days, second stage surgery was performed using a midcrestal incision to expose the cover screw. A provisional restoration was fabricated at chair side using self-curing acrylic resin (ALIKE™, GC AMERICA INC, IL, USA) over the prefabricated titanium temporary abutment.
12) The provisional restoration was then inserted and cemented with eugenol temporary cement (Fig 8).
13) The final restoration was delivered 3-6 months after the stage 2 surgery (Fig 9).
14) The Modified Pink Esthetic Score and Patient Satisfaction Questionnaire were recorded at 3 and 12 months after delivery of final restoration and average scores determined.

## RESULTS

Sixteen implants in 10 patients placed with the MEIP protocol showed a 100% survival rate. Loading time ranged from 6 to 15 months (Table 1). The MPES and PSQ averages were 8.4 (varied from 7 to 10) and 9 (varied from 8 to 10) respectively (Table 2). Out of the 16 implants placed, 2 showed partial loss of the interdental papilla and minor buccal mucosal recession of < 1mm.

## DISCUSSION

A recent systematic review evaluating alveolar bone dimensional changes of extraction sockets in humans showed that on average the reduction in width of the alveolar ridge was 3.87mm (13). In addition IIP has been shown to have no impact on this remodeling process, making it a potentially risky procedure for aesthetic failure if patients are not well selected (14-16). Therefore it is advisable in some cases to perform a staged surgical approach including bone augmentation. Following extraction it would be desirable to arrest the bone resorptive process or at least minimize it, with treatment that would preserve the bone for the proposed implant prosthesis (17). A recent review showed that socket preservation may aid in reducing the bone dimensional changes following tooth extraction, but does not prevent bone resorption (18). Therefore, in addition to socket preservation therapy, alternative therapies should be explored, such as EIP with simultaneous GBR augmentation.

The early implant placement (EIP) technique is characterized by careful extraction of the tooth without flap elevation, debridement of the socket, followed by a 4-8 weeks soft tissue healing period. This is followed by implant placement in a correct three-dimensional position, simultaneous contour augmentation on the facial aspect with GBR using a bio-absorbable collagen membrane combined with or without autogenous chips and a low substitution bone filler and tension-free primary wound closure (8). Instead of EIP, implants may then be placed 2-4 weeks following extraction with simultaneous bone augmentation (MEIP). The classical healing extraction literature describes a process

| Patient | No of Implants | Site # | Time of Placement After Extraction | Size | Loading Time (mon) | Survival Rate (%) |
|---|---|---|---|---|---|---|
| 1 | 2 | 8, 9 | 4 weeks | ø4.8/3.3-13mm, ø4.8/3.3-13mm | 15 | 100 |
| 2 | 2 | 7, 9 | 4 weeks | ø4.8/3.3-13mm, ø4.8/3.3-13mm | 15 | 100 |
| 3 | 1 | 9 | 4 weeks | ø4.8/3.3-13mm | 15 | 100 |
| 4 | 1 | 8 | 3 weeks | ø4.8/3.3-13mm | 15 | 100 |
| 5 | 2 | 9, 10 | 3 weeks | ø4.8/4.1-13mm, ø4.8/4.1-13mm | 15 | 100 |
| 6 | 2 | 8, 9 | 3 weeks | ø4.8/4.1-13mm, ø4.8/4.1-13mm | 9 | 100 |
| 7 | 2 | 8, 9 | 4 weeks | ø4.8/4.1-13mm, ø4.8/4.1-13mm | 6 | 100 |
| 8 | 2 | 8, 9 | 2 weeks | ø3.5-10mm, ø3.5-10mm | 14 | 100 |
| 9 | 1 | 10 | 3 weeks | ø3.25-13mm | 6 | 100 |
| 10 | 1 | 7 | 3 weeks | ø4.0-13mm | 6 | 100 |

Table 1. Implant survival rates

| Patients | Average MPES | Average PSQ |
|---|---|---|
| 1 | 7 | 8 |
| 2 | 8 | 9.5 |
| 3 | 7.5 | 8 |
| 4 | 10 | 10 |
| 5 | 8.5 | 9.5 |
| 6 | 8 | 9 |
| 7 | 8 | 9 |
| 8 | 9 | 9 |
| 9 | 9 | 9 |
| 10 | 9 | 9 |
| **Mean** | **8.4** | **9** |

Table 2. Esthetic outcomes

whereby granulation tissue replaces the clot over 4-5 days postextraction period (9, 16, 17). At 2-3 weeks, connective tissue gradually replaces the granulation tissue and osteoid is seen at the base and periphery of the socket. Complete epithelial connective tissue closure of the socket is usually achieved in 4-5 weeks (9). When implants are placed during this time period (2-4 weeks after extraction), the connective tissue and granulation tissue provide the surgical site with increased blood supply. This serves a beneficial role for the healing of the simultaneous implant placement and GBR procedure. With the palatally inclined crestal incision design used in the present study, granulation tissue in the socket can be part of the labial flap to ensure easier flap closure. Following tooth extraction, significant ridge alterations usually occur on the facial aspect during the healing process (21, 22). Because of this, GBR procedures are recommended to be performed simultaneously in the EIP protocol to maintain facial hard and soft tissue morphology for good esthetic outcomes (10).

The present retrospective study of 10 patients provides evidence that the MEIP protocol in the anterior maxilla offers successful treatment outcomes with high predictability and a low risk for complications. The results of this study showed a survival rate of 100% (Table 1). Other studies with a different implant placement time lines reported results comparable to that obtained in this study. In a controlled clinical and histological study in humans Paolantonio et al. (23), showed no significant difference in the clinical and radiographic parameters between IIP and DIP with cumulative implant survival rate (CISR) of 100% 1 year following implantation. In a similar study, Polizzi et al. (5) evaluated implant placement into fresh extraction sockets. They reported a CISR of 92.4% and 94.7% in the maxilla and mandible respectively after 5 years of loading. Buser et al. in a prospective case series of EIP with simultaneous GBR reported a survival and success rate of 100% at 12 months of follow up (10). These results when compared with the results of the present study show little differences between the 4 time lines of IIP, EIP, MEIP and DIP protocols however, more data is needed from multiple centers to confirm these findings.

In a study of IIP, Furhauer et al. (24) reported a mean PES of 9.3 (out of 14). In a recent case series, Buser et al. (10) reported a mean MPES of 8.1 (out of 10) with use of EIP protocol. In the present study, the mean MPES was 8.4. The results of the present study appear to show little variation compared to IIP, EIP and DIP protocols (2, 5, 10) (Table 3). Patients were satisfied with the esthetic outcome of the final restoration according to the results of the PSQ (Table 2). The high esthetic outcomes reported in the present study may be related to following factors:

1) Incision design- Maintenance of intact papilla following atraumatic extraction. Papillae saving and palatally inclined crestal incisions were used at the time of implant placement. Also, the use of a slit incision design or punch to expose the cover screw at stage 2 surgery.

| | DIP | IIP | EIP | MEIP |
|---|---|---|---|---|
| **Time of Implant Placement After Extraction** | 3-6 months | 0 day | 4-8 weeks | **2-4 weeks** |
| **No. of Surgical Procedures Ext/ Implant Placement** | 2 | 1 | 2 | **2** |
| **Primary Stability** | Native Bone | Apical/ Lateral Stabilization | Apical/ Lateral Stabilization | **Apical/ Lateral Stabilization** |
| **GBR** | If needed | Implant-socket distance > 2mm | Always needed | **Always needed** |
| **Primary Closure** | Yes | No | Yes | **Yes** |
| **Implant Survival Rate(%)** | 96.6 | 92.4-94.7 | 100 | **100** |
| **Esthetic Outcome** | N/A | 9.3/14(PES) | 8.1/10(MPES) | **8.4/10(MPES)** |
| **Autor** | **Albrektsson T (1986)** | **Polizzi G (2000)** | **Buser D (2009)** | **Tormeti D (2010)** |

Table 3. Comparison of 4 different timeline

2) Platform switching- The platform switching design helped to maintain the primary implant stability achieved by preventing or minimizing crestal bone loss of implants at the provisional stage and final restoration (25).
3) Soft tissue management- The MEIP approach allowed adequate soft tissue volume which aided in primary closure. This primary closure is a key factor of successful implant, grafting and esthetic outcomes.
4) Temporization- Proper temporization of the implant helps in molding the soft tissue prior to final restoration. Exaggerated embrasure spaces were created to allow potential growth of interproximal soft tissue coronally.

Complications in the present study occurred around 2 out of 16 implants placed. In one case, the 'papilla height' value of MPES was lower than other cases causing a reduction in the score (Pt. 1, Table 2). In another case, the patient showed minor mucosal recession (of <1mm). The papilla reduction could be due to a distal vertical incision used during stage 2 surgery. Another explanation might be that anatomical factors caused the partial loss of papilla because there was bone loss on the adjacent tooth. Studies clearly indicate that bone level of adjacent tooth is an important factor for peri-implant papilla height when an implant is placed next to tooth (26). The potential causes of the marginal soft tissue recession include thin biotype and facial malpositioning of the implant in the ridge. This underscores the importance of proper case selection and risk assessment prior to surgery. Inclusion criteria in the future should expanded to include periodontal biotype and height of interdental bone since these are important determinants for good clinical outcomes (26, 27).



## CONCLUSIONS

This case series shows that the MEIP protocol is a viable option in achieving successful esthetic outcomes while reducing implant treatment time. Case selection with reference to soft tissue biotype, extraction socket morphology, alveolar bone height on the adjacent tooth, incision design, platform switching abutment design and good patient compliance are factors that should be considered for a successful outcome. Nevertheless, prospective studies with long term follow-up are necessary to identify the factors and considerations for predictable treatment outcome.

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## ACKNOWLEDGMENT

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